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Sekiya

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(54) **DRESSING BOARD, CUTTING BLADE DRESSING METHOD, AND CUTTING APPARATUS**

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(30) **Foreign Application Priority Data**

Jan. 17, 2017 (JP) 2017-006006

(51) **Int. Cl.**

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H01L 21/78	(2006.01)
H01L 21/304	(2006.01)
B24B 53/017	(2012.01)
H01L 21/683	(2006.01)
B24B 3/36	(2006.01)
B23Q 3/08	(2006.01)
H01L 21/67	(2006.01)

(52) **U.S. Cl.**

CPC ***B24B 53/14*** (2013.01); ***B23Q 3/088*** (2013.01); ***B24B 3/368*** (2013.01); ***B24B 53/017*** (2013.01); ***H01L 21/3043*** (2013.01); ***H01L 21/67092*** (2013.01); ***H01L 21/67294*** (2013.01); ***H01L 21/78*** (2013.01); *H01L 21/6838* (2013.01)

(58) **Field of Classification Search**

CPC B24B 53/14; B24B 3/368; B24B 53/017; B23Q 3/088; H01L 21/043; H01L 21/67092; H01L 21/67294; H01L 21/78; H01L 21/6838

See application file for complete search history.

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(57) **ABSTRACT**

Disclosed herein is a dressing board for dressing a cutting blade. The dressing board is held on a chuck table in dressing the cutting blade. The dressing board includes a bar code formed on the front side of the dressing board for indicating kind information on the dressing board, and a groove code formed on the front side of the dressing board at an edge portion thereof, the groove code being composed of grooves having pattern corresponding to that of the bar code. Even when the bar code is cut off by the cutting blade in dressing the cutting blade, the kind information on the dressing board is indicated by the groove code left on the front side of the dressing board.

4 Claims, 9 Drawing Sheets

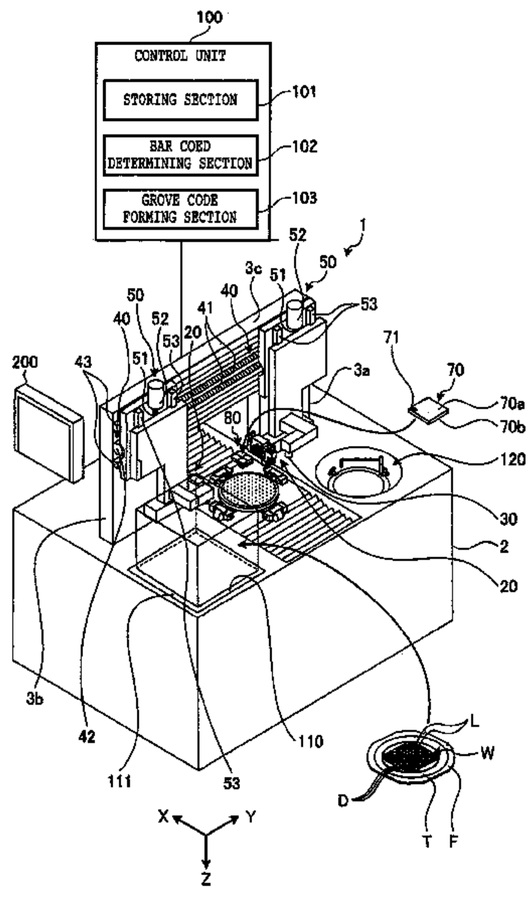


FIG. 1

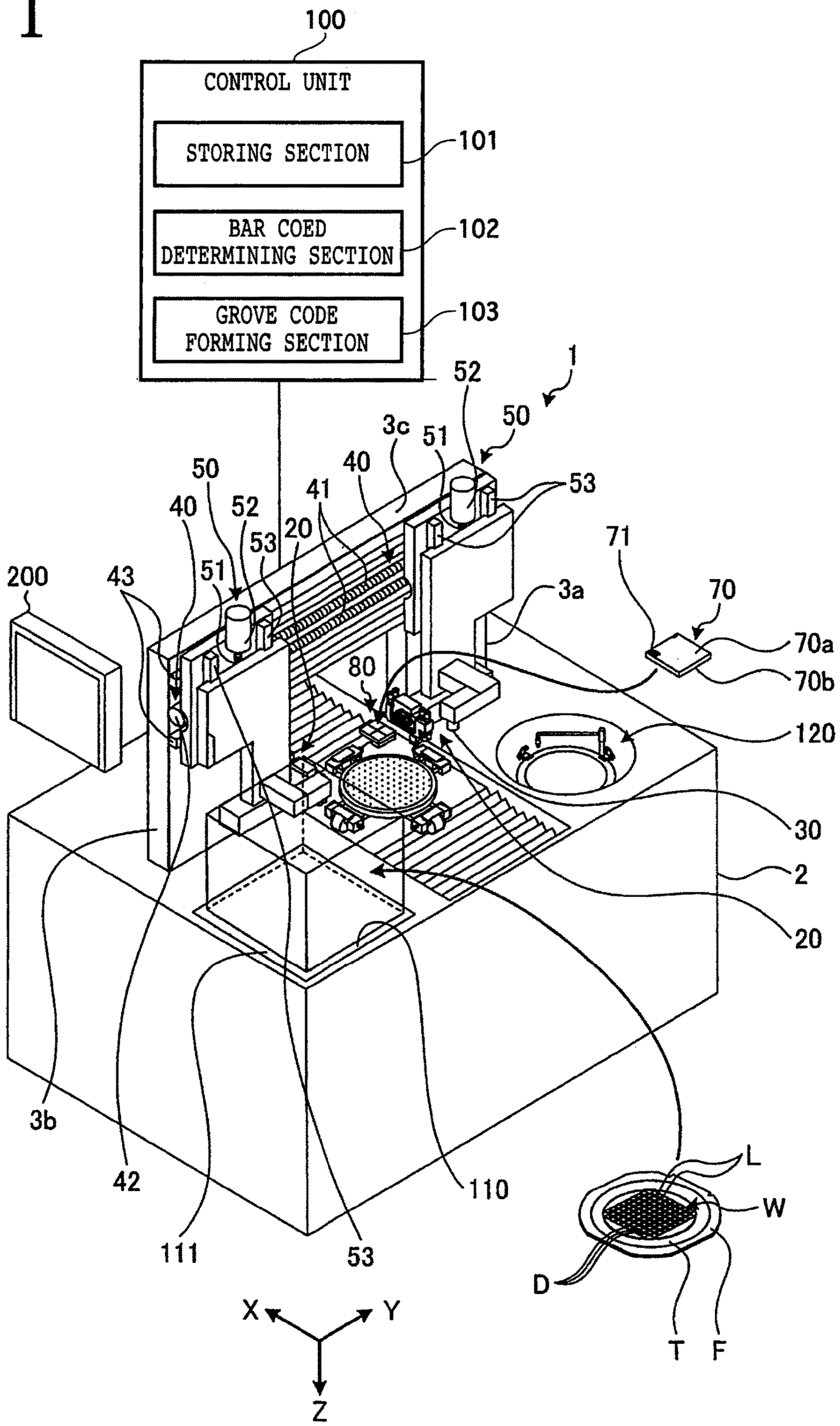

100
CONTROL UNIT
STORING SECTION
101
BAR COED DETERMINING SECTION
102
GROVE CODE FORMING SECTION
103
52
1
50
3c
51
40
50
53
41
40
52
20
53
71
200
43
51
3a
70
70a
70b
80
120
30
2
20
3b
42
111
53
110
L
W
D
T
F
X
Y
Z

FIG.2

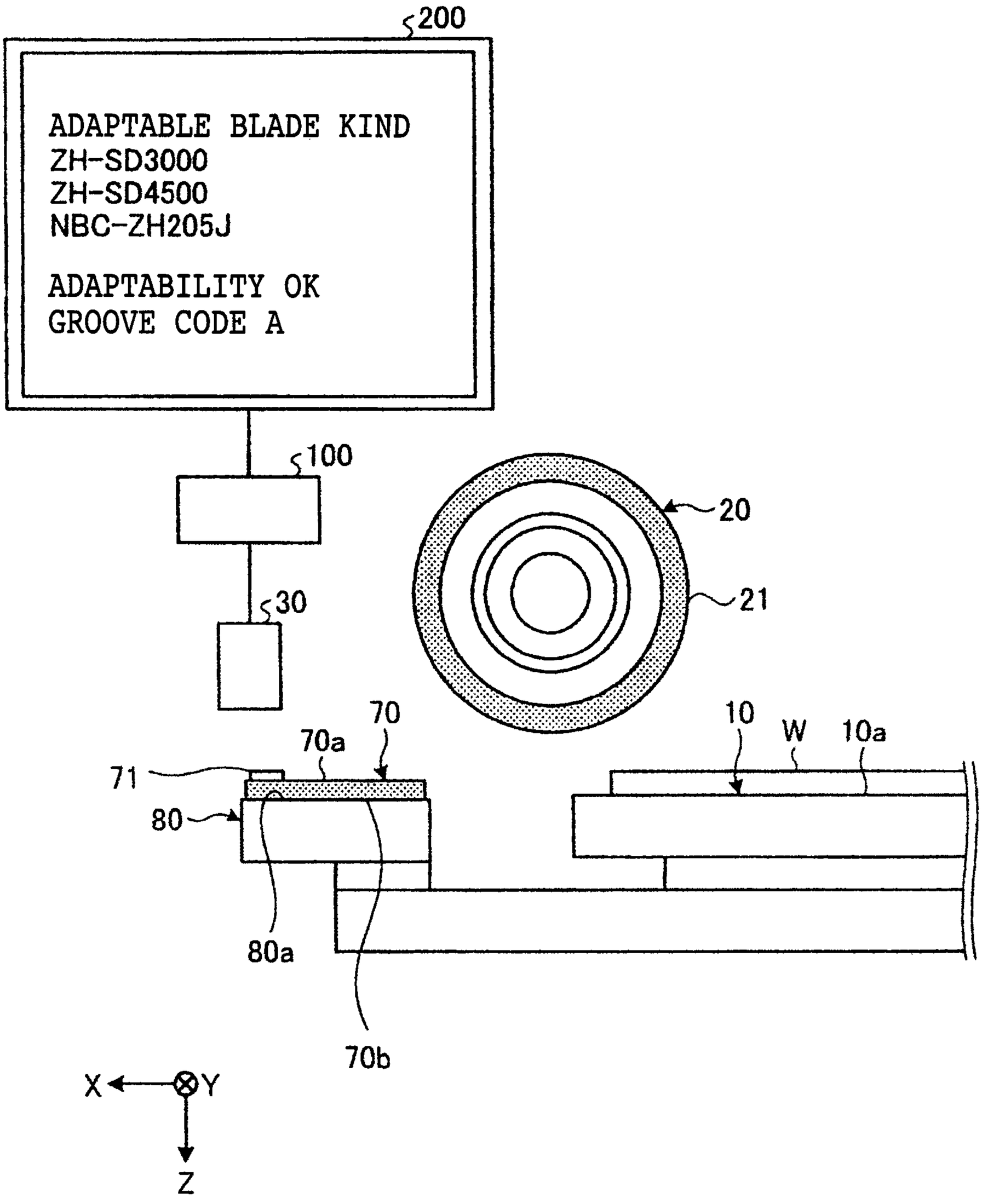

200
ADAPTABLE BLADE KIND
ZH-SD3000
ZH-SD4500
NBC-ZH205J
ADAPTABILITY OK
GROOVE CODE A
100
30
20
21
70
70a
71
80
80a
70b
10
W
10a
X
Y
Z

FIG.3

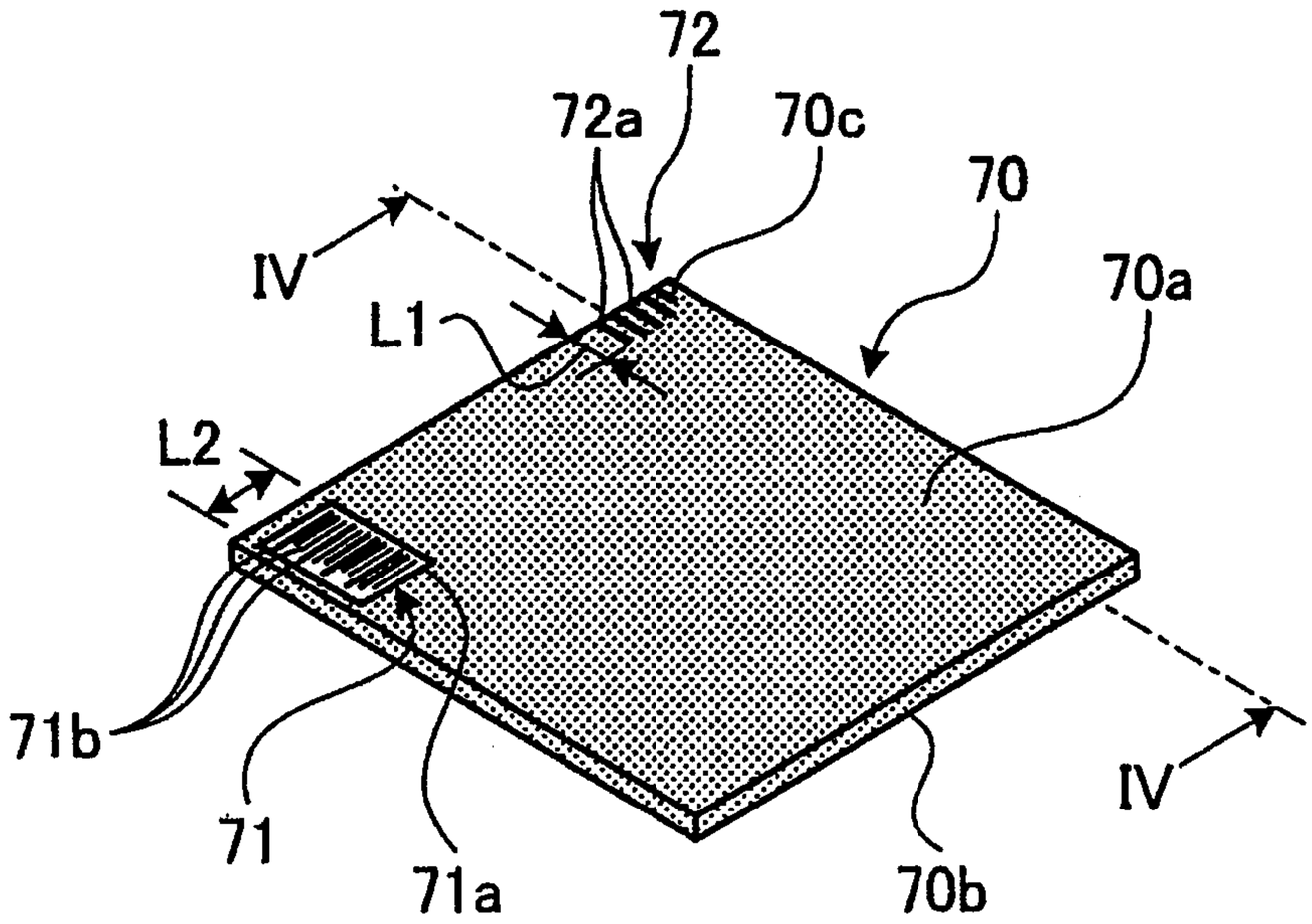


FIG.4

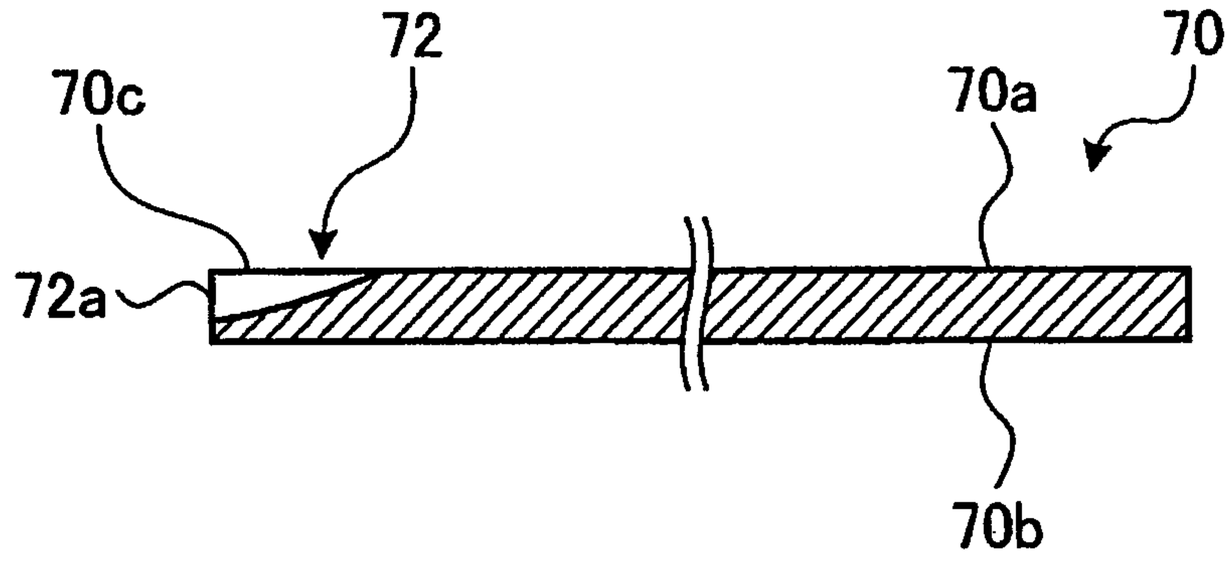


FIG.5

RD

KIND OF CUTTING BLADE	KIND OF DRESSING BOARD	KIND OF GROOVE CODE
CUTTING BLADES A TO D	DRESSING BOARD A	GROOVE CODE A
CUTTING BLADES E TO G	DRESSING BOARD B	GROOVE CODE B
CUTTING BLADES H TO J	DRESSING BOARD C	GROOVE CODE C

FIG.6

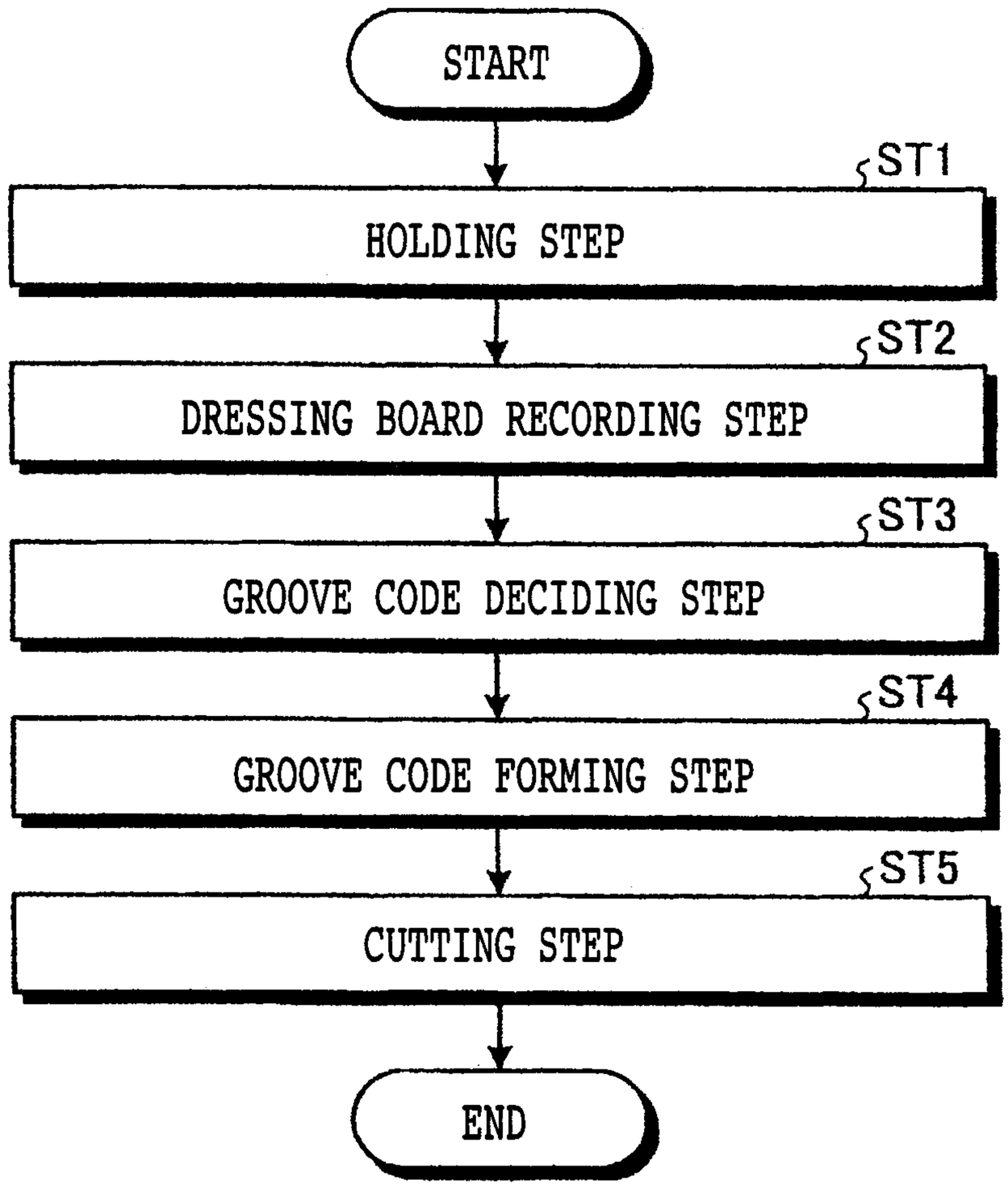


FIG.7

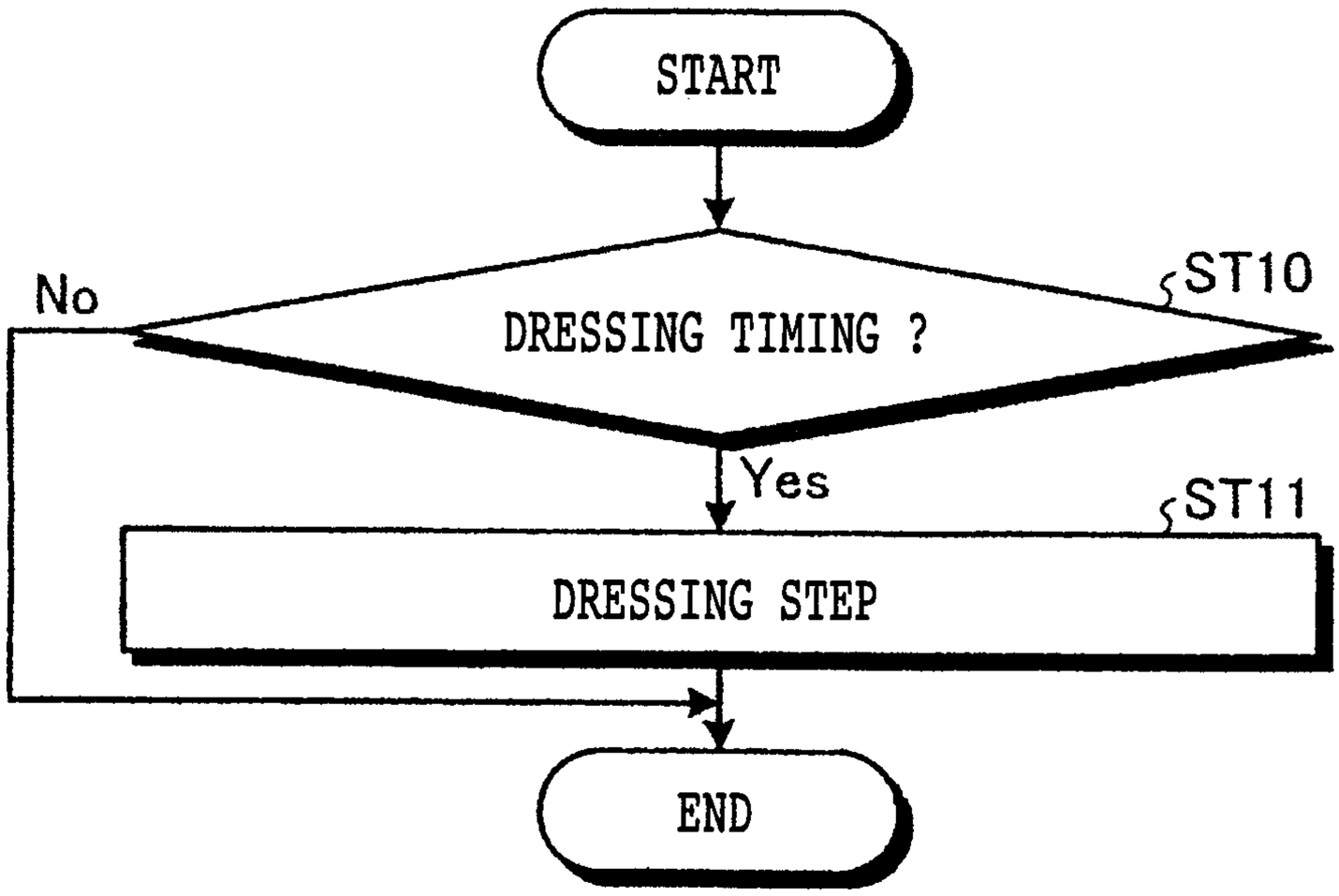

START
ST10
No
DRESSING TIMING ?
Yes
ST11
DRESSING STEP
END

FIG.8

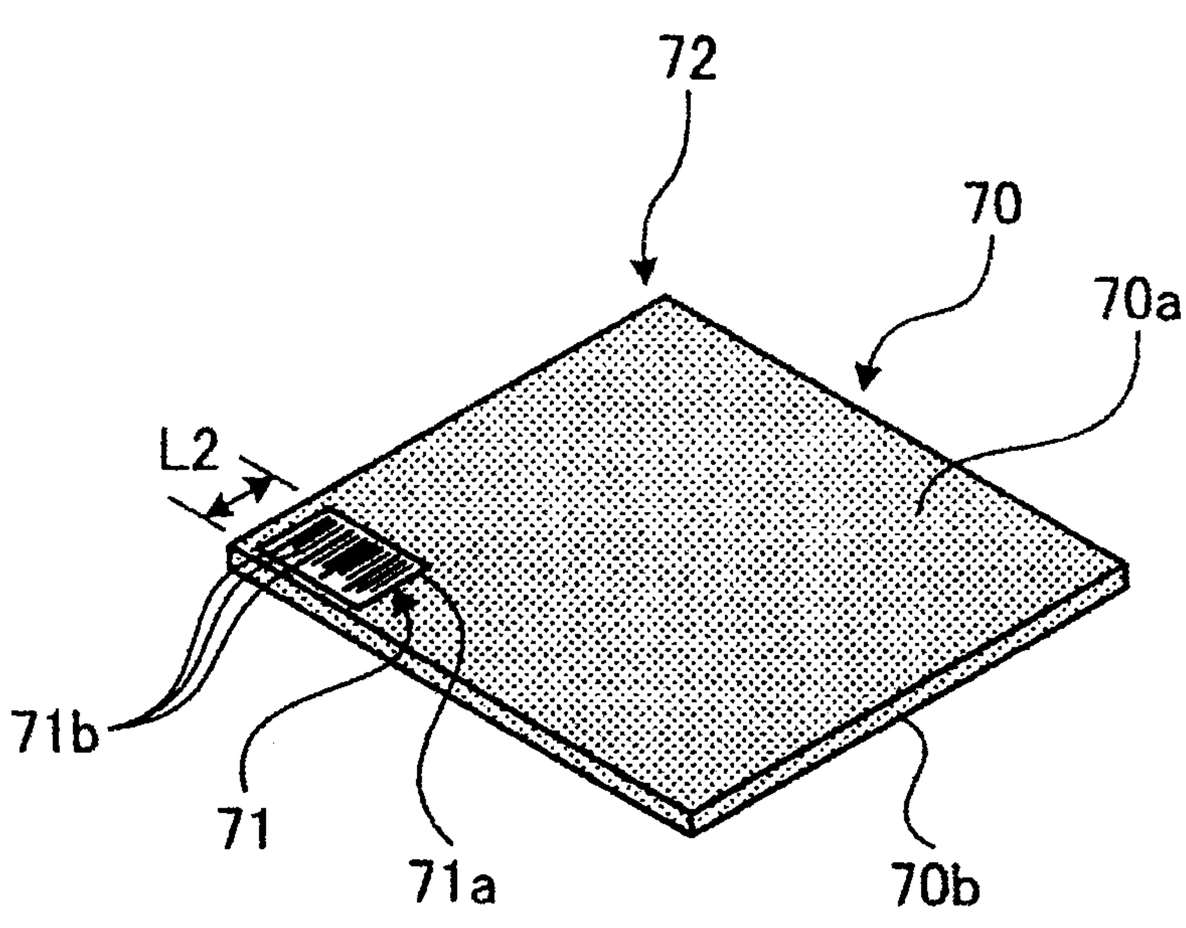

72
70
70a
L2
71b
71
71a
70b

FIG.9

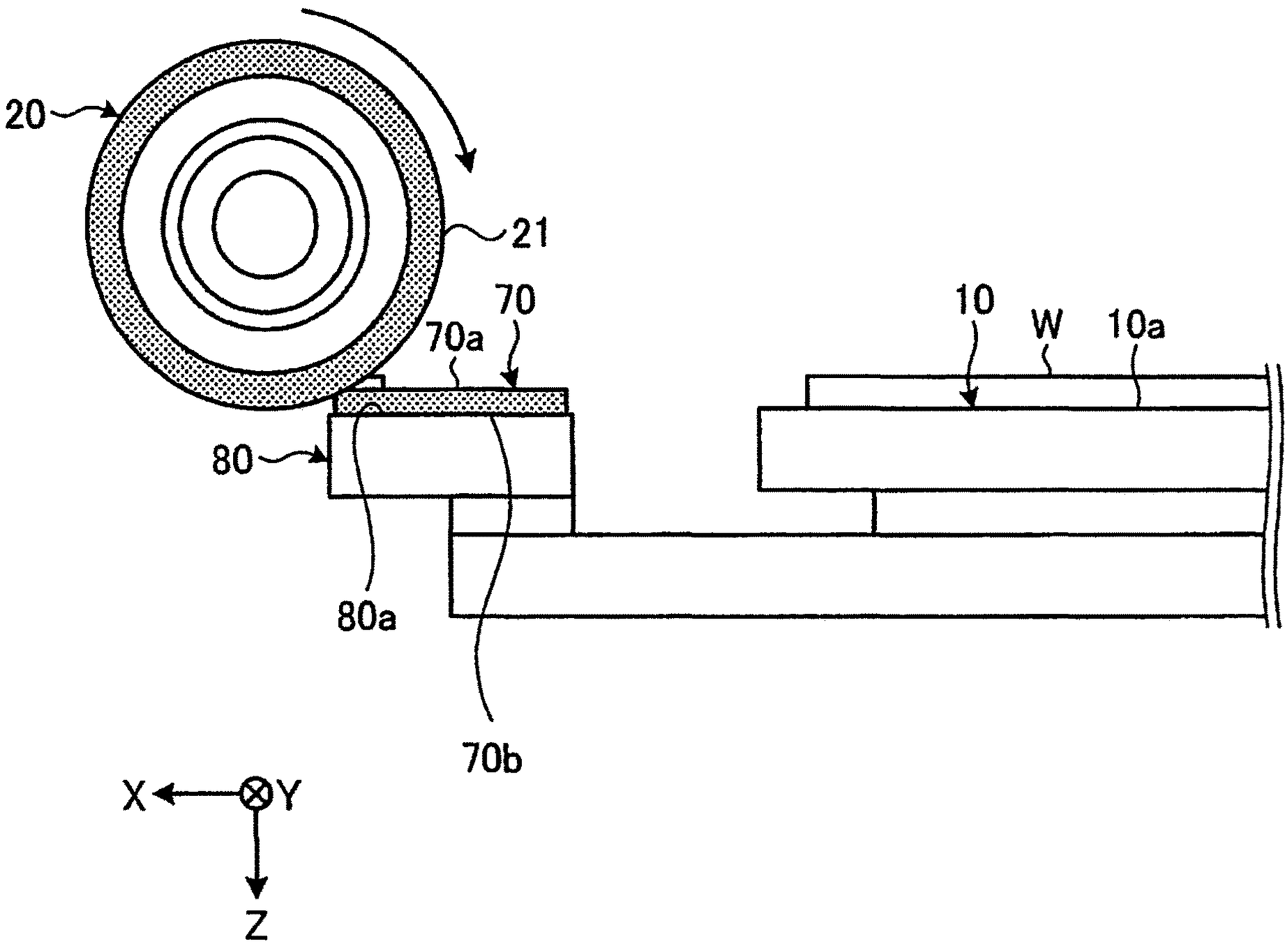


FIG. 10

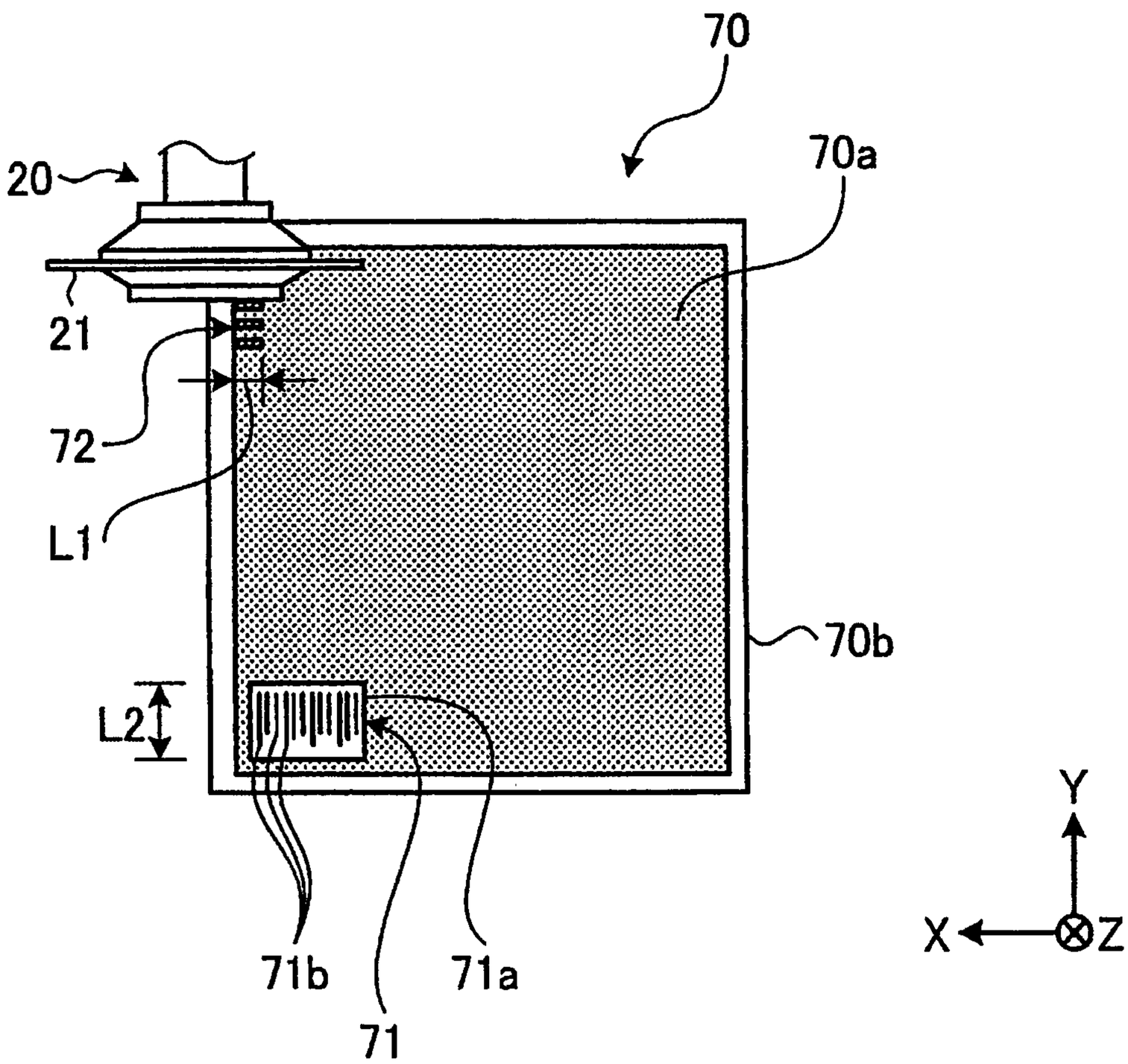


FIG. 11

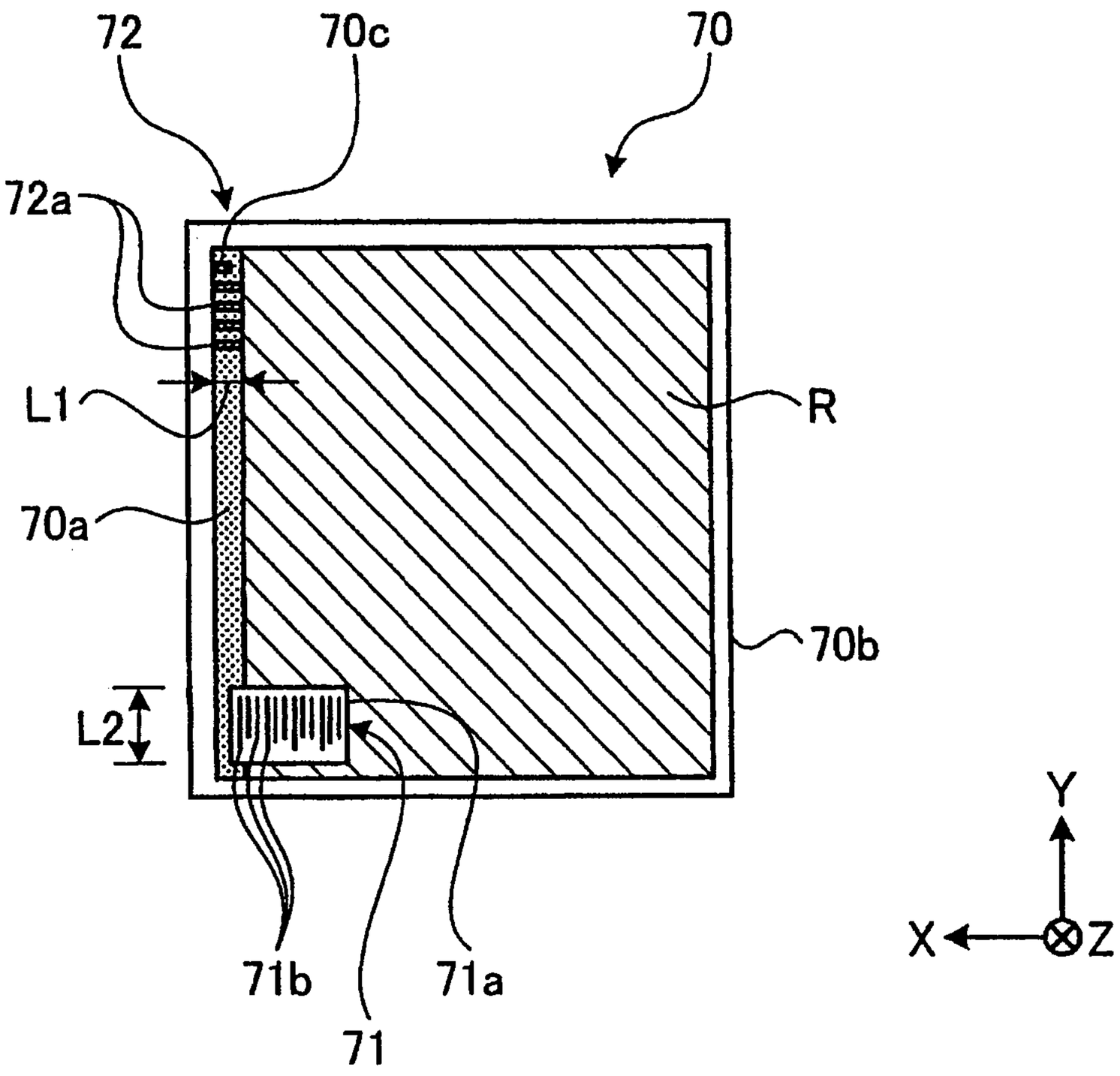
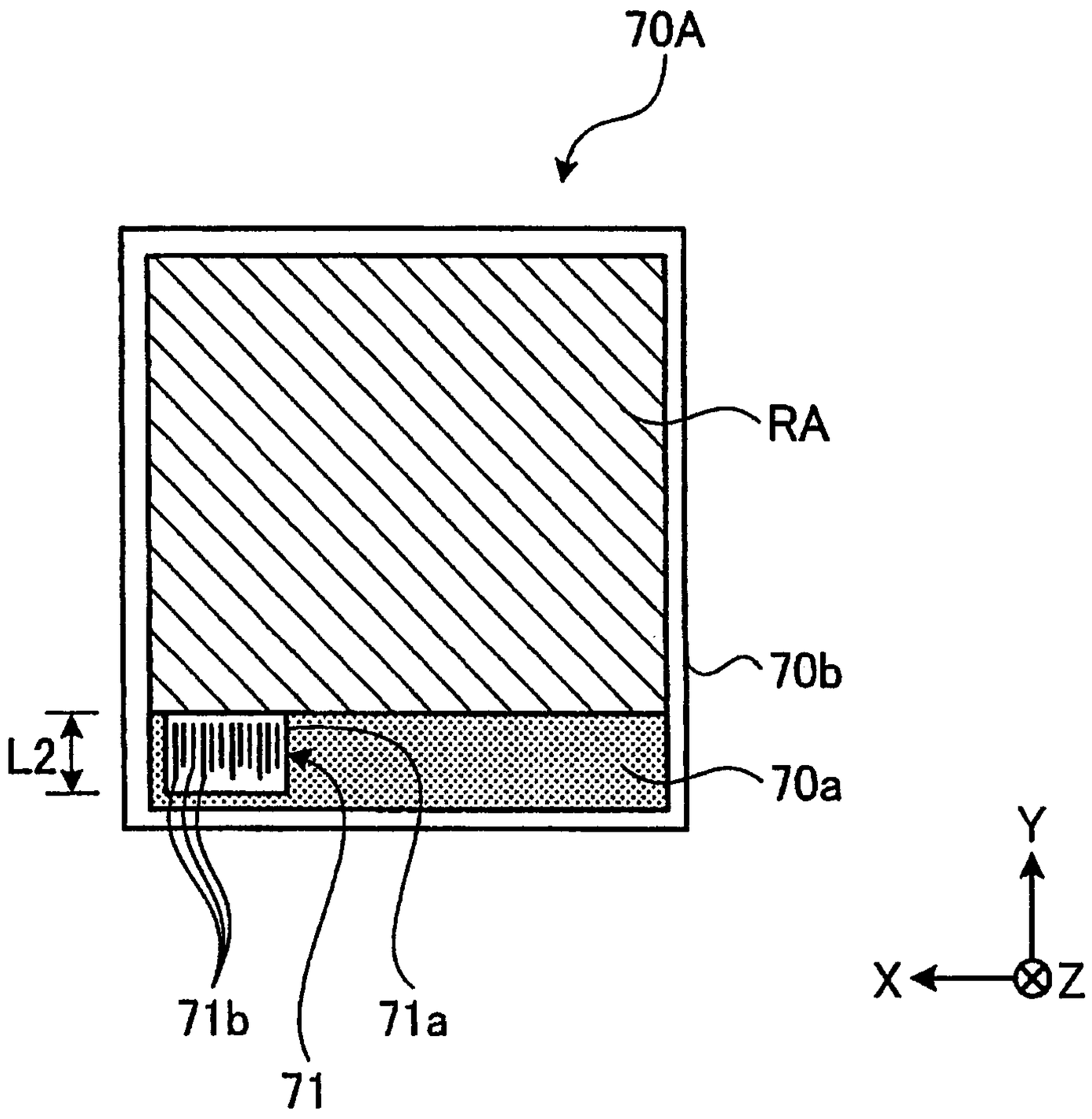


FIG. 12 PRIOR ART



DRESSING BOARD, CUTTING BLADE DRESSING METHOD, AND CUTTING APPARATUS

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a dressing board, a cutting blade dressing method, and a cutting apparatus.

Description of the Related Art

A cutting apparatus using a cutting blade is known as a processing apparatus for cutting various plate-shaped workpieces such as a semiconductor wafer and a packaged substrate with high accuracy. In the cutting apparatus, the cutting blade mounted on a spindle is subjected to dressing for the purposes of recovering the roundness and the cutting performance of the cutting blade. A dressing board is used to perform the dressing of the cutting blade. The dressing board is configured by mixing abrasive grains such as WA (white alundum, or alumina) and GC (green carbonite, or silicon carbide) in a bond formed of resin or ceramic. The dressing is performed by cutting the dressing board with the cutting blade, so that the cutting blade is worn to some extent (see Japanese Patent No. 5541657, for example).

The dressing board described in Japanese Patent No. 5541657 has a plurality of kinds because the bond and the abrasive grains are selected according to the kind of the cutting blade. Accordingly, if the dressing board is erroneously selected, that is, if the combination of the dressing board and the cutting blade is improper, there is a possibility that the roundness of the cutting blade cannot be recovered or the cutting blade may be dulled in cutting performance, resulting in a reduction in performance of the cutting blade. To cope with this problem, there has been developed a dressing board having a bar code, wherein the bar code formed on the dressing board mounted in a cutting apparatus is read into the cutting apparatus to identify the kind of the dressing board mounted in the cutting apparatus (see Japanese Patent Laid-open No. 2012-066328, for example).

SUMMARY OF THE INVENTION

In the dressing board described in Japanese Patent Laid-open No. 2012-066328, however, the bar code is formed on the front side of the dressing board, so that there is a possibility that the bar code may be removed by cutting the front side of the dressing board with the cutting blade. As a result, the kind of the dressing board mounted in the cutting apparatus cannot be identified. Further, when the front side of the dressing board is cut in a dressable area except the bar code, this dressable area is reduced to cause poor economy.

It is therefore an object of the present invention to provide a dressing board, a cutting blade dressing method, and a cutting apparatus which can ensure a large dressable area for dressing a cutting blade and can simultaneously identify the kind of the dressing board mounted in the cutting apparatus.

In accordance with an aspect of the present invention, there is provided a dressing board for dressing a cutting blade, the dressing board having a front side and a back side opposite to the front side, the back side of the dressing board being held on a chuck table in dressing the cutting blade, the dressing board including: a bar code formed on the front side of the dressing board for indicating kind information on the dressing board; and a groove code formed on the front side of the dressing board at an edge portion thereof, the groove code being composed of grooves having a pattern corresponding to that of the bar code. Even when the bar code is cut off by the cutting blade in dressing the cutting blade, the kind information on the dressing board is indicated by the groove code left on the front side of the dressing board.

Preferably, the kind information on the dressing board is indicated by using the width of each groove, the number of the grooves, the spacing between the grooves, and the length of each groove.

In accordance with another aspect of the present invention, there is provided a cutting blade dressing method of dressing a cutting blade by using a dressing board having a front side and a back side opposite to the front side, the front side having a bar code for indicating kind information on the dressing board, the cutting blade dressing method including: a holding step of holding the dressing board on a chuck table in the condition where the front side of the dressing board is exposed; a dressing board recording step of imaging the bar code of the dressing board held on the chuck table and next recording the kind information on the dressing board as included in the bar code, to a control unit of a cutting apparatus; a groove code deciding step of deciding a pattern of a groove code to be formed on the front side of the dressing board at an edge portion thereof, according to the kind information recorded in the dressing board recording step; a groove code forming step of forming the pattern of the groove code decided in the groove code deciding step, on the front side of the dressing board at the edge portion by using the cutting blade; and a dressing step of cutting the front side of the dressing board after performing the groove code forming step, by using the cutting blade, thereby dressing the cutting blade.

In accordance with a further aspect of the present invention, there is provided a cutting apparatus including: a chuck table for holding a workpiece; an auxiliary chuck table for holding a dressing board having a front side on which a bar code is formed, the bar code indicating kind information on the dressing board; a cutting unit having a cutting blade for cutting the workpiece held on the chuck table; an imaging unit for imaging the workpiece held on the chuck table and also imaging the bar code of the dressing board; and a control unit for controlling the chuck table, the auxiliary chuck table, the cutting unit, and the imaging unit. The control unit includes: a bar code determining section for operating the imaging unit to image the bar code of the dressing board held on the auxiliary chuck table and determining the kind information on the dressing board as included in the bar code; and a groove code forming section for converting the kind information included in the bar code into a pattern of a groove code and forming the groove code corresponding to the bar code at an edge portion of the dressing board.

The above and other objects, features and advantages of the present invention and the manner of realizing them will become more apparent, and the invention itself will best be understood from a study of the following description and appended claims with reference to the attached drawings showing a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view depicting the configuration of a cutting apparatus according to a preferred embodiment of the present invention;

FIG. **2** is a side view depicting an essential part of the cutting apparatus depicted in FIG. **1**;

FIG. **3** is a perspective view depicting a dressing board according to this preferred embodiment;

FIG. **4** is a cross section taken along the line IV-IV in FIG. **3**;

FIG. **5** is a table depicting recorded data stored in a control unit included in the cutting apparatus depicted in FIG. **1**;

FIG. **6** is a flowchart depicting a part of the flow of a cutting blade dressing method according to this preferred embodiment;

FIG. **7** is a flowchart depicting the remainder of the flow of the cutting blade dressing method;

FIG. **8** is a perspective view depicting an original dressing board to be held in a holding step constituting the cutting blade dressing method depicted in FIG. **6**;

FIG. **9** is a side view depicting a groove code forming step constituting the cutting blade dressing method depicted in FIG. **6**;

FIG. **10** is a plan view depicting the groove code forming step depicted in FIG. **9**;

FIG. **11** is a plan view depicting a dressing board having a groove code formed by the groove code forming step depicted in FIGS. **9** and **10**; and

FIG. **12** is a plan view depicting a dressing board having no groove code as a comparison.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention will now be described in detail with reference to the drawings. The present invention is not limited to this preferred embodiment. Further, the components used in this preferred embodiment may include those that can be easily assumed by persons skilled in the art or substantially the same elements as those known in the art. Further, the configurations described below may be suitably combined. Further, the configurations may be variously omitted, replaced, or changed without departing from the scope of the present invention.

Referring to FIG. **1**, there is depicted a cutting apparatus **1** according to a preferred embodiment of the present invention. The cutting apparatus **1** is an apparatus for cutting (processing) a platelike workpiece W. In this preferred embodiment, the workpiece W is a disk-shaped semiconductor wafer or optical device wafer formed of silicon, sapphire, or gallium arsenide, for example, as a base material. The workpiece W has a front side WS and a back side WR. A plurality of crossing division lines L are formed on the front side WS of the wafer W to thereby define a plurality of separate regions where a plurality of devices D are formed. As a modification, the workpiece W may be a so-called TAIKO wafer having a thin central portion and a thick peripheral portion. Further, the workpiece W may be a rectangular packaged substrate having a plurality of devices sealed with resin, rather than a disk-shaped wafer. Further, the workpiece W may be a ceramic plate or a glass plate, for example. An adhesive tape T as a protective member is attached at its central portion to the back side WR of the workpiece W. An annular frame F is mounted on a peripheral portion of the adhesive tape T.

The cutting apparatus **1** is an apparatus for cutting the workpiece W along the division lines L by using a cutting blade **21** (see FIG. **2**) in the condition where the workpiece W is held on a chuck table **10**. As depicted in FIG. **1**, the cutting apparatus **1** includes the chuck table **10** having a holding surface **10***a* (see FIG. **2**) for holding the workpiece W under suction, a pair of cutting units **20** each having the cutting blade **21** for cutting the workpiece W held on the chuck table **10**, an imaging unit **30** for imaging the workpiece W held on the chuck table **10**, and a control unit **100**.

As depicted in FIG. **1**, the cutting apparatus **1** further includes a base housing **2**, an X moving unit (not depicted) for moving (feeding) the chuck table **10** in the X direction depicted by an arrow X, the X direction being parallel to a horizontal direction and a lateral direction of the base housing **2**, a pair of Y moving units **40** for moving (indexing) the pair of cutting units **20** in the Y direction depicted by an arrow Y, the Y direction being parallel to a horizontal direction and a longitudinal direction of the base housing **2** and perpendicular to the X direction, and a pair of Z moving units **50** for moving (feeding) the pair of cutting units **20** in the Z direction depicted by an arrow Z, the Z direction being parallel to a vertical direction perpendicular to both the X direction and the Y direction. Thus, the cutting apparatus **1** is a dual spindle type dicing saw having the two cutting units **20**, or a so-called facing dual type cutting apparatus.

The chuck table **10** is a disk-shaped member, and the holding surface **10***a* for holding the workpiece W is formed of porous ceramic, for example. The chuck table **10** is movable by the X moving unit and also rotatable by a rotational drive source (not depicted). The chuck table **10** is connected to a vacuum source (not depicted), so that the workpiece W can be held on the holding surface **10***a* under suction by a vacuum applied from the vacuum source.

Each cutting unit **20** includes a spindle (not depicted) on which the cutting blade **21** is mounted to cut the workpiece W held on the chuck table **10**. Each cutting unit **20** is movable in the Y direction by the corresponding Y moving unit **40** and also movable in the Z direction by the corresponding Z moving unit **50**, relative to the workpiece W held on the chuck table **10**.

A pair of columns **3***a* and **3***b* stand from the upper surface of the base housing **2**. The columns **3***a* and **3***b* are connected at their upper ends by a horizontal bar **3***c*. One of the two cutting units **20** is supported through the corresponding Y moving unit **40** and the corresponding Z moving unit **50** to the column **3***a*. The other cutting unit **20** is supported through the corresponding Y moving unit **40** and the corresponding Z moving unit **50** to the column **3***b*.

Each cutting unit **20** is adapted to be moved by the corresponding Y moving unit **40** and the corresponding Z moving unit **50**, thereby setting the corresponding cutting blade **21** at an arbitrary position on the holding surface **10***a* of the chuck table **10**. The imaging unit **30** for imaging the front side WS of the workpiece W held on the chuck table **10** is integrated with one of the two cutting units **20** so as to be movable together therewith. The imaging unit **30** includes a CCD (charge coupled device) camera for imaging a target area of the workpiece W to be cut by the cutting blade **21** in the condition where the workpiece W is held on the chuck table **10**. The CCD camera functions to image the workpiece W held on the chuck table **10** and obtain an image for use in performing the alignment between the workpiece W and the cutting blade **21**, then outputting this image to the control unit **100**.

The cutting blade **21** of each cutting unit **20** is a thin ringlike cutting wheel. By rotating the spindle, the cutting blade **21** mounted on the spindle is rotated to cut the workpiece W. The spindle is rotatably mounted in a spindle housing (not depicted) supported to the Z moving unit **50**. The axis of the spindle, or the axis of the cutting blade **21** extends in the Y direction.

The X moving unit functions to move the chuck table **10** in the X direction as a work feeding direction, thereby

relatively moving the chuck table **10** and each cutting unit **20** in the X direction. Each Y moving unit **40** functions to move the corresponding cutting unit **20** in the Y direction as an indexing direction, thereby relatively moving the chuck table **10** and the corresponding cutting unit **20** in the Y direction. Each Z moving unit **50** functions to move the corresponding cutting unit **20** in the Z direction as a cutter feeding direction, thereby relatively moving the chuck table **10** and the corresponding cutting unit **20** in the Z direction.

Although not depicted, the X moving unit includes a known ball screw rotatable about its axis extending in the X direction, a known pulse motor for rotating the ball screw about its axis, and a pair of parallel guide rails for movably supporting the chuck table **10** in such a manner that the chuck table **10** is movable in the X direction by rotating the ball screw. Similarly, each Y moving unit **40** includes a known ball screw **41** rotatable about its axis extending in the Y direction, a known pulse motor **42** for rotating the ball screw **42** about its axis, and a pair of parallel guide rails **43** for movably supporting the corresponding cutting unit **20** in such a manner that the cutting unit **20** is movable in the Y direction by rotating the ball screw **41**. Similarly, each Z moving unit **50** includes a known ball screw **51** rotatable about its axis extending in the Z direction, a known pulse motor **52** for rotating the ball screw **51** about its axis, and a pair of parallel guide rails **53** for movably supporting the corresponding cutting unit **20** in such a manner that the cutting unit **20** is movable in the Z direction by rotating the ball screw **51**.

Although not depicted, the cutting apparatus **1** further includes an X position detecting unit for detecting the X position of the chuck table **10** as the position in the X direction, a Y position detecting unit for detecting the Y position of each cutting unit **20** as the position in the Y direction, and a Z position detecting unit for detecting the Z position of each cutting unit **20** as the position in the Z direction. The X position detecting unit may be composed of a linear scale parallel to the X direction and a read head for reading the linear scale. Similarly, the Y position detecting unit may be composed of a linear scale parallel to the Y direction and a read head for reading the linear scale. The Z position detecting unit may be configured by using the pulses output from the pulse motor **52** to thereby detect the Z position of each cutting unit **20** according to the output pulses. Detection signals output from the X position detecting unit, the Y position detecting unit, and the Z position detecting unit are transmitted to the control unit **100**.

As depicted in FIGS. **1** and **2**, the cutting apparatus **1** further includes an auxiliary chuck table **80** for detachably mounting a dressing board **70**. The auxiliary chuck table **80** is movable in the X direction together with the chuck table **10** and also rotatable by a rotational drive source (not depicted). The auxiliary chuck table **80** is a rectangular member and has an upper surface **80***a* for mounting the dressing board **70**. The upper surface **80***a* of the auxiliary chuck table **80** is set at the same level as that of the holding surface **10***a* of the chuck table **10**. The auxiliary chuck table **80** is connected to a vacuum source (not depicted), so that the dressing board **70** can be held on the upper surface **80***a* under suction by a vacuum applied from the vacuum source. Thus, the auxiliary chuck table **80** is a chuck table for holding the dressing board **70**.

The dressing board **70** functions to dress the cutting blade **21** reduced in its cutting performance due to loading or dulling, thereby restoring the cutting performance of the cutting blade **21**. Thus, dressing the cutting blade **21** means restoring the cutting performance of the cutting blade **21**. That is, the dressing board **70** is a board for dressing the cutting blade **21** in such a manner that the dressing board **70** held on the auxiliary chuck table **80** is cut by the cutting blade **21**.

The dressing board **70** is a rectangular plate having substantially the same shape as that of the upper surface **80***a* of the auxiliary chuck table **80** as viewed in plan. The dressing board **70** is configured by mixing abrasive grains such as WA (white alundum, or alumina) and GC (green carbonite, or silicon carbide) in a bond formed of resin or ceramic.

As depicted in FIG. **3**, the dressing board **70** has a front side (upper surface) **70***a* and a back side (lower surface) **70***b* opposite to the front side **70***a*, the back side **70***b* being adapted to be held on the upper surface **80***a* of the auxiliary chuck table **80**. A bar code **71** and a groove code **72** are provided on the front side **70***a* of the dressing board **70**. The bar code **71** indicates kind information on the dressing board **70**. That is, the kind information means information on the kind (model) etc. of the dressing board **70**. The bar code **71** is a so-called one-dimensional bar code composed of a base sheet **71***a* formed of paper or plastic and attached to the front side **70***a* and a plurality of parallel straight lines **71***b* formed on the front side (upper surface) of the base sheet **71***a*. The plural parallel straight lines **71***b* indicate the kind (model) etc. of the dressing board **70**. The cutting blade **21** is allowed to also cut the bar code **71** of the dressing board **70**.

The groove code **72** is formed on the front side **70***a* of the dressing board **70** at a corner portion **70***c* as an edge portion. The groove code **72** indicates the information corresponding to the bar code **71** (i.e., the kind information on the dressing board **70**). The groove code **72** is composed of at least one groove **72***a*. In this preferred embodiment, a plurality of grooves **72***a* are formed on the front side **70***a* of the dressing board **70** as depicted in FIG. **3**. Each groove **72***a* is formed by linearly cut the front side (upper surface) **70***a* of the dressing board **70** so as to extend to the side surface of the dressing board **70** as depicted in FIG. **4**. Each groove **72***a* is formed in such a manner that the front side **70***a* of the dressing board **70** at the corner portion **70***c* is cut by the cutting blade **21**. In the case that the groove code **72** is composed of the plural grooves **72***a* as in this preferred embodiment, the plural grooves **72***a* are arranged in parallel. The kind information on the dressing board **70** is indicated by using the width of each groove **72***a*, the number of the grooves **72***a*, the spacing between the grooves **72***a*, and the length of each groove **72***a*. The length L**1** of the longest one of the plural grooves **72***a* constituting the groove code **72** is set shorter than the length L**2** of the longest one of the plural straight lines **71***b* constituting the bar code **71**.

The control unit **100** functions to control each component of the cutting apparatus **1** and thereby to perform the processing operation to the workpiece W under control. In this preferred embodiment, the control unit **100** is a computer. The control unit **100** is connected to a display unit **200** such as a liquid crystal display for displaying the condition of the processing operation, the image of the workpiece W, etc. The control unit **100** is also connected to an input unit (not depicted) adapted to be operated by an operator in recording the information on the processing of the workpiece W. This input unit is configured by a touch panel provided in the display unit **200** and/or an external input unit such as a keyboard.

As depicted in FIG. **1**, the control unit **100** includes a storing section **101**, a bar code determining section **102**, and a groove code forming section **103**. The storing section **101** previously stores recorded data RD depicted in FIG. **5**. The

recorded data RD indicates the correspondence among the kind of the cutting blade **21**, the kind of the dressing board **70**, and the kind of the groove code **72** in dressing the cutting blade **21** with the dressing board **70** adapted thereto. The correspondence between the cutting blade **21** and the dressing board **70** as indicated by the recorded data RD means the adaptation of the dressing board **70** to the cutting blade **21** to be dressed by the dressing board **70**.

The bar code determining section **102** functions to determine (identify) the kind information on the dressing board **70**, i.e., the information on the kind of the dressing board **70**, wherein the kind information is included in the bar code **71**, according to an image of the bar code **71** as obtained by the imaging unit **30**. That is, the bar code **71** formed on the exposed front side **70***a* of the dressing board **70** held on the auxiliary chuck table **80** is imaged by the imaging unit **30**, and the image of the bar code **71** obtained by the imaging unit **30** is sent to the bar code determining section **102**.

The groove code forming section **103** functions to convert the kind information included in the bar code **71** and determined by the bar code determining section **102**, into the groove code **72** and then form the groove code **72** corresponding to the bar code **71** at the corner portion **70***c* as an edge portion of the dressing board **70** by using the cutting blade **21** under control. That is, the groove code forming section **103** functions to refer to the recorded data RD depicted in FIG. **5** and then determine the kind of the groove code **72** corresponding to the kind information on the dressing board **70** as included in the bar code **71** and determined by the bar code determining section **102**. The groove code forming section **103** further functions to control the cutting blade **21** and form the groove code **72** determined above at the corner portion **70***c* as an edge portion of the dressing board **70** by using the cutting blade **21**.

The control unit **100** functions to determine whether or not the cutting blade **21** mounted on the spindle is a cutting blade of the kind corresponding to the kind of the dressing board **70** held on the auxiliary chuck table **80**, by referring to the recorded data RD depicted in FIG. **5**. In other words, the control unit **100** functions to determine whether or not the cutting blade **21** mounted on the spindle is adapted to the dressing using the dressing board **70** held on the auxiliary chuck table **80**.

The cutting apparatus **1** further includes a cassette elevator **110** for mounting a cassette **111** thereon and moving the cassette **111** in the Z direction, wherein a plurality of workpieces W are stored in the cassette **111** before and after performing the cutting operation in the cutting apparatus **1**. The cutting apparatus **1** further includes a cleaning unit **120** for cleaning each workpiece W after performing the cutting operation and a transfer unit (not depicted) for drawing the workpiece W from the cassette **111** before cutting, storing the workpiece W into the cassette **111** after cutting, and transferring the workpiece W to a predetermined position.

There will now be described the operation of the cutting apparatus **1** according to this preferred embodiment, that is, a cutting blade dressing method according to this preferred embodiment with reference to the drawings. FIG. **6** is a flowchart depicting a part of the flow of the cutting blade dressing method according to this preferred embodiment. FIG. **7** is a flowchart depicting the remainder of the flow of the cutting blade dressing method according to this preferred embodiment. FIG. **8** is a perspective view depicting an original dressing board to be held in a holding step constituting the cutting blade dressing method depicted in FIG. **6**. FIG. **9** is a side view depicting a groove code forming step constituting the cutting blade dressing method depicted in FIG. **6**. FIG. **10** is a plan view depicting the groove code forming step depicted in FIG. **9**. FIG. **11** is a plan view of the dressing board on which the groove code has been formed by the groove code forming step depicted in FIGS. **9** and **10**. FIG. **12** is a plan view similar to FIG. **11**, depicting a comparison.

The cutting blade dressing method which will be hereinafter referred to simply as "dressing method") according to this preferred embodiment is a dressing method using the cutting apparatus **1** depicted in FIG. **1** and this method is included in a cutting method for the workpiece W. Prior to starting the dressing method, the information on the processing of the workpiece W is recorded into the control unit **100** by the operator, and the dressing board **70** is set on the upper surface **80***a* of the auxiliary chuck table **80** by the operator. When starting of the processing is instructed by the operator, the dressing method is started. The information on the processing of the workpiece W includes the kind (model) of the cutting blade **21** mounted on the spindle of the cutting unit **20**. More specifically, the cassette **111** storing the plural workpieces W to be cut is first set on the cassette elevator **110** by the operator. Further, the dressing board **70** is set on the upper surface **80***a* of the auxiliary chuck table **80** by the operator, wherein the dressing board **70** at this time is an original dressing board having no groove code. When starting of the processing is next instructed by the operator, the dressing method is started by the control unit **100**.

As depicted in FIG. **6**, the dressing method includes a holding step ST**1**, dressing board recording step ST**2**, groove code deciding step ST**3**, groove code forming step ST**4**, cutting step ST**5**, and dressing step ST**11** (see FIG. **7**).

The holding step ST**1** is the step of holding the dressing board **70** on the auxiliary chuck table **80** in the condition where the front side **70***a* having the bar code **71** is exposed as depicted in FIG. **8**, before forming the groove code **72** on the front side **70***a*. In the holding step ST**1**, the control unit **100** operates the vacuum source connected to the auxiliary chuck table **80** to thereby hold the dressing board **70** on the upper surface **80***a* of the auxiliary chuck table **80**.

The dressing board recording step ST**2** is the step of imaging the bar code **71** of the dressing board **70** held on the auxiliary chuck table **80** by using the imaging unit **30** and then recording the kind information included in the bar code **71** of the dressing board **70** to the control unit **100**. In the dressing board recording step ST**2**, the control unit **100** controls the X moving unit and the Y moving unit **40** to make the imaging unit **30** be opposed to the bar code **71** of the dressing board **70**, then operating the imaging unit **30** to image the bar code **71**. Thereafter, the bar code determining section **102** in the control unit **100** determines (identifies) the kind of the dressing board **70** indicated by the bar code **71**, according to the image obtained by the imaging unit **30** and then stores the kind of the dressing board **70** determined above.

The groove code deciding step ST**3** is the step of deciding the pattern of the groove code **72** to be formed at the corner portion **70***c* of the dressing board **70**, according to the information recorded in the dressing board recording step ST**2**. In the groove code deciding step ST**3**, the groove code forming section **103** in the control unit **100** refers to the recorded data RD to identify the kind of the groove code **72** corresponding to the kind of the dressing board **70** determined in the dressing board recording step ST**2**. Further, in the groove code deciding step ST**3**, the control unit **100** refers to the information on the processing of the workpiece W as previously input, the kind of the dressing board **70** as determined in the dressing board recording step ST**2**, and the

recorded data RD and then determines whether or not the dressing board **70** held on the auxiliary chuck table **80** is adapted to the dressing of the cutting blade **21** mounted on the spindle. Thereafter, as depicted in FIG. **2**, the control unit **100** controls the display unit **200** to display the kind of the groove code **72** identified above, the adaptability or non-adaptability between the dressing board **70** and the cutting blade **21**, and the kind of the cutting blade **21** adaptable to the kind of the dressing board **70** determined in the dressing board recording step ST**2**.

The groove code forming step ST**4** is the step of forming the pattern of the groove code **72** as decided in the groove code deciding step ST**3** at the corner portion **70***c* of the dressing board **70** by using the cutting blade **21**. In the groove code forming step ST**4**, the control unit **100** controls the X moving unit, the Y moving unit **40**, and the Z moving unit **50** to cut the corner portion **70***c* of the dressing board **70** by operating the cutting blade **21** as depicted in FIGS. **9** and **10**, thereby forming the groove code **72** of the kind decided by the groove code deciding step ST**3**.

The cutting step ST**5** is the step of cutting the workpiece W held on the chuck table **10** by using the cutting blade **21**. In the cutting step ST**5**, the control unit **100** controls the transfer unit to take one of the plural workpieces W out of the cassette **11** and then transfer the workpiece W to the chuck table **10**, then holding the workpiece W through the adhesive tape T on the holding surface **10***a* of the chuck table **10** under suction. Thereafter, the control unit **10** controls the X moving unit to move the chuck table **10** to the position below one of the two cutting units **20**. Further, the workpiece W held on the chuck table **10** is positioned directly below the imaging unit **30** located adjacent to this cutting unit **20**, and the workpiece W is imaged by the imaging unit **30**. Thereafter, the control unit **100** performs image processing such as pattern matching for performing the alignment between any target one of the division lines L of the workpiece W held on the chuck table **10** and the cutting blade **21** of the cutting unit **20**, and then adjusts the relative position between the workpiece W held on the chuck table **10** and the cutting unit **20**.

Thereafter, the control unit **100** controls the X moving unit, the Y moving unit **40**, the Z moving unit **50**, and the rotational drive source to relatively move the cutting blade **21** and the workpiece W along the target division line L according to the information on the processing of the workpiece W, thereby cutting the workpiece W along the target division line L.

Thereafter, the workpiece W is similarly cut along all of the other division lines L to thereby divide the workpiece W into individual device chips corresponding to the respective devices D. Thereafter, the chuck table **10** is retracted from the position below the cutting unit **20**, and the suction holding of the workpiece W on the chuck table **10** is next canceled. Thereafter, the workpiece W is transferred to the cleaning unit **120** to clean the workpiece W in the cleaning unit **120**. Thereafter, the workpiece W thus processed is returned to the cassette **111** by the transfer unit. This cutting step ST**5** is repeated to sequentially perform the cutting operation to all of the other workpieces W stored in the cassette **11**. When the cutting operation to all the workpieces W stored in the cassette **111** is finished, the operation by the cutting apparatus **1** is ended.

During the cutting step ST**5**, the control unit **100** determines whether or not dressing timing has been reached (step ST**10**). When the control unit **100** determines that the dressing timing has not been reached (step ST**10**: No), the step ST**10** is repeated. This dressing time means the timing for dressing the cutting blade **21**. For example, the dressing timing is set as the timing when cutting of the workpiece W along a predetermined number of division lines L has been finished. As a modification, the dressing timing may be set as any arbitrary timing during the processing of one workpiece W or as the timing when the workpiece W is replaced by another workpiece W in sequentially performing the cutting operation to the plural workpieces W.

In contrast, when the control unit **100** determines that the dressing timing has been reached (step ST**10**: Yes), the dressing step ST**11** is performed to cut the front side **70***a* of the dressing board **70** having the groove code **72** by using the cutting blade **21**, thereby dressing the cutting blade **21**. In the dressing step ST**11**, the control unit **100** controls the X moving unit, the Y moving unit **40**, and the Z moving unit **50** to cut the front side **70***a* of the dressing board **70** with the cutting blade **21**, thereby dressing the cutting blade **21**. As depicted in FIG. **11**, the cutting blade **21** is dressed in an area R depicted as a hatched area on the front side **70***a* of the dressing board **70**, wherein this area R does not include the groove code **72**, but includes at least a part of the bar code **71**. Accordingly, even when the bar code **71** is cut off by the cutting blade **21** in the dressing step ST**11**, the groove code **72** left on the front side **70***a* of the dressing board **70** can indicate the kind information on the dressing board **70**. After performing the dressing step ST**11**, the program returns to the step ST**10**.

According to the dressing board **70**, the dressing method, and the cutting apparatus **1** as described above, the groove code **72** having a pattern corresponding to the bar code **71** previously formed on the front side **70***a* of the dressing board **70** is formed at the corner portion **70***c* of the dressing board **70**, so that is possible to ensure the large area R where the cutting blade **21** can be dressed. Further, according to the dressing method and the cutting apparatus **1**, the groove code **72** is formed by the cutting blade **21** according to the bar code **71**, so that it is unnecessary to prepare any apparatus for specifically forming the groove code **72**. That is, the groove code **72** can be formed on the dressing board **70** by using the cutting apparatus **1** for cutting the workpiece W. Accordingly, the groove code **72** can be formed at low cost, and erroneous selection of the dressing board **70** can be easily prevented.

Further, according to the dressing board **70**, the dressing method, and the cutting apparatus **1**, the length L**1** of the longest groove **72***a* in the groove code **72** is set shorter than the length L**2** of the longest line **71***b* in the bar code **71**. Accordingly, the area R where dressing is allowed as depicted in FIG. **11** can be reliably made larger than an area RA of a dressing board **70**A depicted in FIG. **12** as a comparison. In the dressing board **70**A as a comparison depicted in FIG. **12**, the groove code **72** is not formed on the front side **70***a*, but only the bar code **71** is formed on the front side **70***a*. The area RA does not include the bar code **71**, and the cutting blade **21** can be dressed in this area RA. In FIG. **12**, the same parts as those depicted in FIG. **11** are denoted by the same reference numerals.

Accordingly, in the dressing board **70**, the dressing method, and the cutting apparatus **1**, the groove code **72** is composed of the plural grooves **72***a* shorter than the plural lines **71***b* constituting the bar code **71**, so that the large area R for dressing the cutting blade **21** can be ensured and at the same time the kind of the dressing board **70** mounted in the cutting apparatus **1** can be identified.

The control unit **100** of the cutting apparatus **1** according to this preferred embodiment has a processing unit having a microprocessor such as CPU (central processing unit), a storing unit having a memory such as ROM (read only

memory) and RAM (random access memory), and an input/output interface unit. The processing unit in the control unit **100** functions to perform processing (computing) according to a computer program stored in the storing unit and output a control signal for controlling the cutting apparatus **1** through the input/output interface unit to each component of the cutting apparatus **1**. The functions of the control unit **100**, the bar code determining section **102**, and the groove code forming section **103** are realized by the processing unit in such a manner that the computer program stored in the storing unit is executed by the processing unit and that necessary information is stored into the storing unit by the processing unit. The function of the storing section **101** in the control unit **100** is realized by the storing unit.

The present invention is not limited to the above preferred embodiment. That is, various modifications may be made without departing from the scope of the present invention.

The present invention is not limited to the details of the above described preferred embodiment. The scope of the invention is defined by the appended claims and all changes and modifications as fall within the equivalence of the scope of the claims are therefore to be embraced by the invention.

What is claimed is:

1. A dressing board for dressing a cutting blade, the dressing board having a front side and a back side opposite to the front side, the back side of the dressing board being held on a chuck table in dressing the cutting blade, the dressing board comprising:

a bar code formed on the front side of the dressing board for indicating kind information on the dressing board; and

a groove code formed on the front side of the dressing board at an edge portion thereof, the groove code being composed of grooves having a pattern corresponding to that of the bar code;

wherein even when the bar code is cut off by the cutting blade in dressing the cutting blade, the kind information on the dressing board is indicated by the groove code left on the front side of the dressing board.

2. The dressing board according to claim **1**, wherein the kind information on the dressing board is indicated by using the width of each groove, the number of the grooves, the spacing between the grooves, and the length of each groove.

3. A cutting blade dressing method of dressing a cutting blade by using a dressing board having a front side and a back side opposite to the front side, the front side having a bar code for indicating kind information on the dressing board, the cutting blade dressing method comprising:

a holding step of holding the dressing board on a chuck table in a condition where the front side of the dressing board is exposed;

a dressing board recording step of imaging the bar code of the dressing board held on the chuck table and next recording the kind information on the dressing board as included in the bar code, to a control unit of a cutting apparatus;

a groove code deciding step of deciding a pattern of a groove code to be formed on the front side of the dressing board at an edge portion thereof, according to the kind information recorded in the dressing board recording step;

a groove code forming step of forming the pattern of the groove code decided in the groove code deciding step, on the front side of the dressing board at the edge portion by using the cutting blade; and

a dressing step of cutting the front side of the dressing board after performing the groove code forming step, by using the cutting blade, thereby dressing the cutting blade.

4. A cutting apparatus comprising:

a chuck table for holding a workpiece;

an auxiliary chuck table for holding a dressing board having a front side on which a bar code is formed, the bar code indicating kind information on the dressing board;

a cutting unit having a cutting blade for cutting the workpiece held on the chuck table;

an imaging unit for imaging the workpiece held on the chuck table and also imaging the bar code of the dressing board; and

a control unit for controlling the chuck table, the auxiliary chuck table, the cutting unit, and the imaging unit;

the control unit including

a bar code determining section for operating the imaging unit to image the bar code of the dressing board held on the auxiliary chuck table and determining the kind information on the dressing board as included in the bar code, and

a groove code forming section for converting the kind information included in the bar code into a pattern of a groove code and forming the groove code corresponding to the bar code at an edge portion of the dressing board.

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